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Corn, Wheat and Soy Bean Meal with Skim Milk for Pork Production

University of Tennessee Agricultural Experiment Station

Andrew M. Soule

John R. Fain

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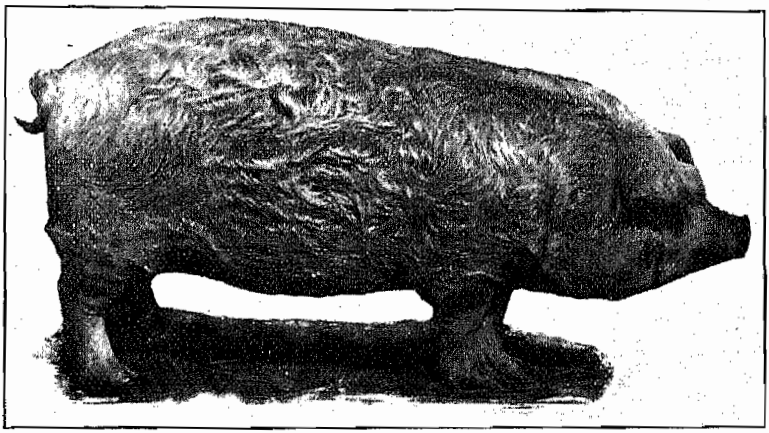

A PROFITABLE TYPE

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CORN, WHEAT AND SOY BEAN MEAL WITH SKIM MILK FOR PORK PRODUCTION

BY

ANDREW M. SOULE AND JOHN R. FAIN

KNOXVILLE, TENNESSEE

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CORN, WHEAT AND SOY BEAN MEAL WITH SKIM MILK FOR PORK PRODUCTION

INTRODUCTION

The value of corn for pork production was long since recognized; but changes in economic conditions have increased the price of corn during the past few years and made it necessary for the farmer to consider what grain crops he can grow or feed as a substitute for a portion of the corn so as to cheapen the cost of production and at the same time improve the quality of the pork. The cheapness of corn in the past has in one sense been a detriment to the progress of swine husbandry; it has encouraged a too general use of this cereal for the development of the choicest quality of hams and bacon or for the good of breeding animals. When corn was very cheap it was a common practice to shut the hogs up in a filthy pen and feed them an unlimited quantity without regard to cost. This made fat hogs of what is generally known as the "lard type." Close confinement and heavy feeding impaired the stamina and vigor of the animals and undoubtedly resulted in undermining the constitution of the brood sow and this with the unsanitary quarters caused the destruction of large numbers of hogs by the dreaded cholera.

Hog breeders now realize that an open range with grass and forage crops is a desideratum of the greatest importance to them. Under such conditions a superior quality of pork is obtained with a better admixture of fat and lean. As can be easily understood from these facts and many others which might be adduced, conditions with regard to swine feeding have materially changed. Hence it becomes necessary to determine what grains may be substituted to advantage for a part of the corn formerly fed, and to utilize fully such by-products of the farm as slops and skim milk, which were frequently allowed to go to waste, but which are now known to have a high feeding value.

FEEDING PERIOD

The experiments extended over a period of two years. The first test was made with 24 hogs divided into eight groups of three each, and commenced January 12, 1902, and continued for 60 days. A duplicate experiment was made in 1903, commencing December 29 and continuing for 77 days. In this test 32 animals were used, divided into eight groups of four each. The repetition of the experiment was deemed advisable in order to eliminate the influence of individuality as much as possible by securing a record from a larger number of animals.

THE OBJECTS OF THE EXPERIMENT

These trials were undertaken for the purpose of studying the value of corn meal alone and of corn meal when fed in combination with varying amounts of skim milk for pork production; and also to determine the effects of substituting wheat meal and soy bean meal for a portion of the corn meal when all the adjuncts were fed in combination with skim milk.

Many people complain that the dairy business, especially when the object in view is butter making, is not so profitable as it should be; but in many cases comparatively little attention is paid to the proper utilization of skim milk as a hog food. Finally, it is very important for every farmer to realize more fully the best proportions in which to feed corn and skim milk in order to obtain the largest gain with the least waste of food.

It has sometimes happened that the millers were not willing to pay a profitable price for wheat; at other times rain has injured it or it could not be placed on sale at the most propitious time because of bad roads or distance from market. On every farm where cereals are grown to any considerable extent there is an accumulation of refuse which if ground has a high feeding value. Occasionally the farmer has wheat on his hands which he thinks he must sell at a great sacrifice when it would be worth considerably more to him if ground and fed to some kind of stock. These reasons coupled with the fact that Tennessee is well adapted for the production of cereals make it advisable to determine the merit of wheat as an adjunct in pork production.

Soy beans take kindly to Tennessee conditions. The plant being a legume the seed is rich in protein and well suited to feeding young animals or those in which it is desirable to produce a better admixture of fat and lean meat than is obtained from corn alone. As soy beans yield well—the best varieties producing from 20 to 35 bushels per acre—the crop is one that will occupy a very important place in Southern agriculture once its true merits become known. Owing to the facility with which it can be cultivated and to its many excellent qualities, the extent to which this crop could be utilized as an adjunct in feeding swine seemed to be an important question.

ANIMALS USED

Five of the hogs used in the experiment of 1902 were Chester White grades bred on the University farm; the remainder were purchased and were said to be Chester White and Berkshire cross. These animals were above the average in quality, as the gains made during the experiment would indicate. The 32 hogs used in the experiment of 1903 were purchased in an adjoining county. These were grade Berkshires, but they were inferior in quality to those used in the previous experiment, as is evident from the smaller and less uniform gains made.

The hogs were confined in pens and fed twice a day. During the winter of 1902 the weather was cool and bracing and uniformly dry; in 1903 the weather was raw and damp with an excessive rainfall and this no doubt had an influence on the general health of the hogs.

COST OF FOOD

The following values were assigned to the foods used in 1902 and 1903, being based on the market prices prevailing at the time:

1902—	Per ton
Corn and wheat meal, ratio 2 to 1	$29.00
Corn and soy bean meal, ratio 2 to 1	33.00
Corn meal	28.00
Skim milk	4.00

1903—	Per ton
Corn and wheat meal, ratio 2 to 1	$22.00
Corn and soy bean meal, ratio 2 to 1	25.00
Corn meal	19.00
Skim milk	4.00

RATIONS USED

The rations fed per animal are shown together with the initial and final weights and the total pounds of gain:

Group	Ration Fed	1902—Fed 60 Days Initial lbs.		1902—Fed 60 Days Final lbs.		1903—Fed 77 Days Initial lbs.		1903—Fed 77 Days Final lbs.	
I	Corn meal.....2 Wheat meal 1	1		3.70		1.25		3.12	
	Skim milk	3		11.0		3.00		9.4	
	Average wt. of hogs	64.0		155.0		87.5		176.7	
	Total gain.....		91.0				89.2		
II	Corn meal.....2 Wheat meal 1	1		3.16		1.25		2.75	
	Skim milk	6		19.0		7.50		16.5	
	Average wt. of hogs.....	68.0		156.3		89.2		176.5	
	Total gain.....		87.5				87.3		
III	Corn meal.....2 Wheat meal 1	1		2.66		1.25		2.40	
	Skim milk.....	9		24.0		11.25		21.4	
	Average wt. of hogs	62.8		151.6		99.2		190.0	
	Total gain		88.8				98.8		
IV.	Corn meal.....2 Wheat meal 1	1		2.16		1.25		2.10	
	Skim milk.....	12		26.0		15.00		24.0	
	Average wt. of hogs.....	73.6		169.0		103.7		192.0	
	Total gain		95.4				88.3		
V	Corn meal.....	1		3.33		1.25		2.10	
	Average wt. of hogs.....	61.8		115.3		72.7		91.2	
	Total gain.....		53.5				18.5		
VI	Corn meal.....	1		3.33		1.25		2.10	
	Skim milk.....	8		23.3		10.00		16.0	
	Average wt. of hogs.....	61.6		164.6		72.7		150.0	
	Total gain		103.0				77.3		
VII	Corn meal.....2 Wheat meal 1	1		3.33		1.25		2.10	
	Skim milk.....	8		23.3		10.00		16.0	
	Average wt. of hogs.....	59.5		158.2		72.2		150.7	
	Total gain.....		98.7				78.3		
VIII	Corn meal.....2 Soy bean meal.....1	1		3.33		1.25		2.10	
	Skim milk.....	8		23.3		10.00		16.0	
	Average wt. of hogs.....	60.3		157.6		78.7		159.2	
	Total gain.....		97.3				80.5		

OBSERVATIONS

The first four groups received 2 parts of corn meal and 1 part of wheat meal with varying amounts of skim milk. The skim milk was fed to the four groups in the ratio of 1 pound of grain to 3, 6, 9 and 12 pounds of skim milk, respectively. It was the endeavor to maintain the same ratio as far as possible throughout the experiment. An examination of the table will show how nearly this result was achieved. The large amount of skim milk a hog of medium weight will consume in a day is surprising; but it is possible to feed him more than he can utilize to the best advantage, as the tables further on indicate.

The ratios of grain per 100 pounds of live weight at the beginning and the end of the experiment were not always the same; nor were the ratios of skim milk. This shows the varying individuality of the animals and the necessity of feeding according to the returns made and not according to any theoretical standard.

TABLE I—*Food consumed, 1902-1903*

Group	Lot	Number in lot	Proportion between concentrates and milk		Concentrates—lbs.			Skim milk —lbs.
			Concentrates	Milk	Corn meal	Corn meal 2 Wheat meal 1	Corn meal 2 Soja bean meal 1	
I	1- 9	3-4	1	3	.....	681.9	.....	2046.1
II	2-10	3-4	1	6	.....	590.3	.....	3545.0
III	3-11	3-4	1	9	.....	517.1	.....	4654.1
IV	4-12	3-4	1	12	.....	435.5	.....	5226.0
V	5-13	3-4	1	.....	488.5	.....	.....	.....
VI	6-14	3-4	1	8	480.8	.....	.....	3685.5
VII	7-15	3-4	1	8	.....	486.5	.....	3699.0
VIII	8-16	3-4	1	8	.....	.....	490.5	3730.5

With the data of the initial and final weights given it is an easy matter to determine in about what ratio the food should be fed per 100 pounds of live weight, so that anyone who contemplates feeding hogs could quickly estimate from the table about the right amount of grain and skim milk and other adjuncts to feed to animals of a given weight. As average hogs do not weigh over 200 to 250 pounds it is more convenient to estimate the amount of food required on the basis of 100 pounds. It should be borne in mind that as hogs increase in size the amount of food required for the maintenance of the body becomes greater and the gains are naturally smaller; hence a larger amount of grain and milk must be fed according to increasing weight and advancing age. The average gain per hog in each group is also shown. It is noteworthy that the gains made in 60 days by the hogs in the experiment of 1902 were as large as those made in 77 days by the hogs in the experiment of 1903, and in some cases larger. While

the conditions set forth in a previous paragraph may have had some influence on these gains the quality of the stock was probably as much at fault.

TABLE II—*Increase in live weight—averages for 1902-1903*

Group	Lot	Number in lot	Number days fed	Live weight—lbs.		Gain—lbs.		
				Initial	Final	Total	Per lot per day	Per head per day
I	1- 9	3-4	68.5	271.0	584.5	313.5	4.6	1.35
II	2-10	3-4	68.5	281.8	587.5	305.7	4.5	1.30
III	3-11	3-4	68.5	276.8	607.5	330.7	4.8	1.40
IV	4-12	3-4	68.5	318.0	637.5	319.5	4.7	1.40
V	5-13	3-4	68.5	236.8	355.5	118.7	1.8	.50
VI	6-14	3-4	68.5	238.0	547.0	309.0	4.6	1.35
VII	7-15	3-4	68.5	234.5	538.8	304.3	4.5	1.30
VIII	8-16	3-4	68.5	248.0	555.0	307.0	4.6	1.30

Table II shows the average increase in live weight of the hogs fed in 1902 and 1903. The largest increase was made by Group III, which received 1 pound of a meal ration, consisting of 2 parts of corn meal and 1 part of wheat meal, to 9 pounds of skim milk. It was apparently the best ratio in which to feed corn meal and skim milk for increase in weight. Observe that 1 pound of grain to 3 pounds of skim milk also made a very satisfactory ration indeed. The smallest gain was made by Group V, which received corn meal and water. This result, which would naturally be expected, shows emphatically the importance of skim milk as an adjunct to a grain ration for hogs. The reading statement which follows presents the daily gain per head per day in live weight for the years 1902 and 1903 as well as the average for the two years:

Group	Gain per head per day 1902 lbs.	1903 lbs.	Average for the two years lbs.
I	1.50	1.20	1.35
II	1.50	1.10	1.30
III	1.50	1.30	1.40
IV	1.60	1.20	1.40
V	.90	.24	.50
VI	1.70	1.00	1.35
VII	1.60	1.00	1.30
VIII	1.60	1.00	1.30

The statement makes it clear that better gains were uniformly made in 1902 than in 1903—a fact undoubtedly due in a large measure to the better grade of hogs fed. The ratio of gain on the different rations in both years was virtually the same, and it is surprising how closely the results coincide except in the case of corn meal and water.

There is naturally a limit to the amount of skim milk hogs can profitably consume, and it is evident from the results shown in Table III that where skim milk is abundant and is utilized freely a considerable amount

of grain can be saved. The reader will recall that skim milk was fed to the first four groups in the ratio of 3, 6, 9 and 12 pounds to a pound of grain. The table shows that Group IV consumed an average of 16.4 pounds of skim milk per pound of gain. It is difficult to get hogs of the age and size used to consume so much milk, and it is therefore evident that the ratio of grain to milk could not be profitably increased. As the gain per head per day made by Group IV was slightly larger than that made by Group I, it is evident that 9.9 pounds of skim milk resulted in a saving of .8 pound of meal. Market prices for grain and milk would determine whether it was profitable to maintain any given ratio. Where 9 pounds of skim milk were fed to 1 pound of grain the saving in grain amounted to .6 pound. With an abundance of skim milk and a larger number of hogs and 50- to 80-cent corn, this saving becomes an important item to the farmer. As the gain per head per day, 1.4 pound, was equivalent to that made with a larger consumption of skim milk, and the saving in grain effected was very small, it might not be profitable on the average farm to feed more than 9 pounds of skim milk to 1 pound of grain; but local conditions will have to determine the proper relationship between the two.

TABLE III—*Food consumed per pound of gain, 1902-1903*

Group	Lot	Number in lot	Total gain—lbs.	Food consumed—lbs.		Food consumed per lb. of gain	
				Concentrates	Skim milk	Concentrates	Skim milk
I	1- 9	3-4	313.5	681.9	2046.1	2.2	6.5
II	2-10	3-4	305.7	590.3	3545.0	1.9	11.6
III	3-11	3-4	330.7	517.1	4654.1	1.6	14.1
IV	4-12	3-4	319.5	435.5	5226.0	1.4	16.4
V	5-13	3-4	118.7	488.5	.....	4.1	.....
VI	6-14	3-4	309.0	480.8	3685.5	1.6	11.9
VII	7-15	3-4	304.3	486.5	3699.0	1.6	12.2
VIII	8-16	3-4	307.0	490.5	3730.5	1.6	12.2

Groups VI, VII and VIII were fed in the ratio of 1 pound of grain to 8 pounds of skim milk, the first lot receiving corn meal and skim milk, the second lot corn and wheat meal, and the third lot corn and soy bean meal. Observe that a pound of gain was made on the three rations from practically the same amount of food. Thus, when corn is high and wheat and soy beans are comparatively cheap one-third of the corn in the ration could easily be replaced by the wheat or the beans with satisfactory results. With the same prices for these three meals a larger amount of wheat or soy beans could undoubtedly be used. If soy beans were anything like as cheap as corn they could be utilized to the greatest advantage in the South in pork making, and the only reason why they are not so cheap is that they are not so extensively grown.

The daily food consumed for a pound of gain for both years and the average of the two are shown in the following table:

Group	1902 Concentrates lbs.	1902 Skim milk lbs.	1903 Concentrates lbs.	1903 Skim milk lbs.	Average Concentrates lbs.	Average Skim milk lbs.
I	1.8	5.5	2.4	7.3	2.2	6.5
II	1.7	10.0	2.1	12.8	1.9	11.6
III	1.4	13.0	1.6	14.8	1.6	14.1
IV	1.2	13.8	1.5	18.4	1.4	16.4
V	2.8	....	7.1	....	4.1	....
VI	1.5	10.5	1.7	13.4	1.6	11.9
VII	1.5	10.9	1.7	13.3	1.6	12.2
VIII	1.5	11.0	1.7	13.2	1.6	12.2

From these figures it is plain that a bushel of corn would produce 13.6 pounds of pork, which at 6 cents per pound would give it a feeding value of 81 cents. If the pork were sold for 5 cents the corn would have a feeding value of 68 cents; if for 7 cents a feeding value of 95 cents. A good deal of pork has been sold in the State the last year or two for 7 cents a pound, and yet there are hundreds of farmers who are letting half-fattened animals go on the market, which of necessity are severely cut by the purchaser. Thus the farmer suffers a great loss because he often thinks it is not profitable to feed 40- to 50-cent corn to hogs bringing him from 5 to 7 cents per pound live weight. When will this delusion concerning the importance of feeding grain to live stock as a means of restoring and building up soil fertility and putting additional profits in the hands of the farmer cease?

Corn has been purchased at the Station farm at 80 cents a bushel and fed to hogs of ordinary grade at a fair profit. The corn was not worth 80 cents on the farm, as it cost considerable to place it on the market, and yet in years when hog products bring a good price and corn can be purchased for 40 cents a bushel it is generally sold instead of kept at home and fed and utilized to the lasting benefit of the owner. There is something wrong here; surely the farmer does not realize the importance of finishing his hogs so as to obtain not only the highest market price for his animals but the highest price for his corn as well. By utilizing skim milk with corn meal in the case of Group VI it was possible to secure 35 pounds of gain from the consumption of a bushel of corn meal with 416.5 pounds of skim milk. On the basis of the gain from corn meal and water 416.5 pounds of skim milk produced 21.4 pounds of gain, which would give the skim milk a feeding value of 31 cents with pork at 6 cents, of 26 cents with pork at 5 cents, and of 36 cents with pork at 7 cents. Skim milk would have practically the same feeding value when fed with a grain ration consisting of 2 parts of corn and 1 part of wheat meal or soy bean meal.

In Table IV is shown the average cost of a pound of gain for both years. The cost of the food is figured at the actual market price, as already set forth. The cost of care is figured on the basis of the time and wages paid the man who fed the animals. The manurial value of the food was obtained on the basis of 15 cents for nitrogen, 5 cents for phosphates and 5 cents for potash. Only 75 per cent of the value of the manure has been considered in figuring out the net cost. As the manure was taken directly

CARCASS OF AN ANIMAL FROM GROUP V, FED CORN MEAL AND WATER AND ONE FROM GROUP VI, FED CORN MEAL AND SKIM MILK

from the pens and well cared for, it should certainly be worth that much. Some people think that in a feeding experiment no account should be taken of the manure. Is not this a surprising position for Southern farmers to take, or for farmers anywhere in the United States, for that matter? Statistics show that more than $54,000,000 a year is spent for fertilizers. Of that amount some $30,000,000, or more than 50 per cent, is spent in the South. Southern soils have been depleted through a failure to rotate crops, through a system of clean culture, and through selling all the products directly from the land instead of keeping them and feeding them to live stock as nature intended. And now the South to reclaim its fertility in the shortest time and in the cheapest and most profitable way must build up its animal industries.

TABLE IV—*Cost of a pound of gain, 1902-1903*

Group	Lot	Number in lot	Total gain—lbs.	Cost of—		Value of manure		Net cost	Cost per lb. of gain	
				food	care	Total	75%		Gross	Net
									cts.	cts.
I	1– 9	3–4	313.5	$12.46	$1.23	$4.57	$3.43	$10.26	4.4	3.3
II	2–10	3–4	305.7	14.35	1.23	5.79	4.34	11.24	5.1	3.7
III	3–11	3–4	330.7	15.67	1.23	6.67	5.00	11.90	5.1	3.6
IV	4–12	3–4	319.5	15.83	1.23	6.97	5.23	11.83	5.3	3.7
V	5–13	3–4	118.7	5.75	1.23	1.61	1.20	5.78	5.8	4.9
VI	6–14	3–4	309.0	12.95	1.23	5.39	4.04	10.14	4.6	3.3
VII	7–15	3–4	304.3	13.54	1.23	5.57	4.18	10.59	4.8	3.5
VIII	8–16	3–4	307.0	14.49	1.23	6.54	4.91	10.81	5.1	3.5

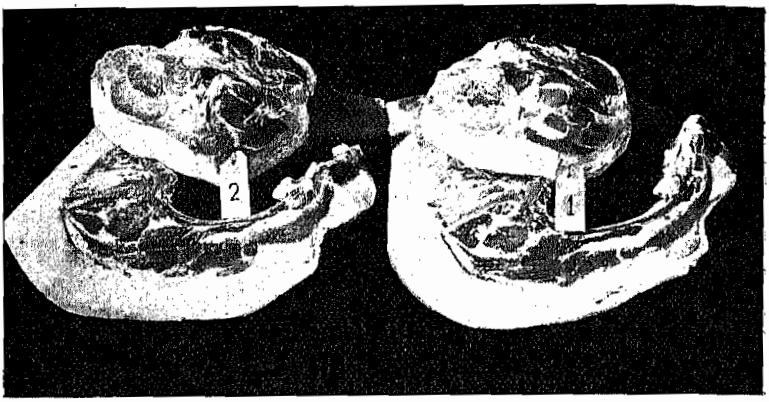
One of the most profitable results from the feeding of live stock, as is now generally recognized the world over, is the possibility of retaining on the farm the fertilizer constituents of the crops grown on the land and so maintaining fertility for an indefinite period. There is thus every reason why the farmer should pay more attention to the value of farm manure. The excrements of the animals in feeding experiments constitute a part of the profits as surely as the sale price, and as such should be considered in figuring out the profits. The manure from these animals is worth more than any commercial fertilizer that can be bought, because when incorporated with a plentiful supply of litter it adds vegetable matter to the soil and improves the mechanical condition as no commercial fertilizer can do. This is not an argument against the use of commercial fertilizer; but in the name of reason, economy and good sense, before commercial fertilizers are purchased let the excrements from farm live stock be preserved and utilized to their utmost limit. If all the farmyard manure which is made in the South were saved and utilized it would reduce the present expenditure for commercial fertilizers by millions of dollars and add materially to the wealth, comfort, happiness and land values of Southern farmers.

As a matter of convenience the cost of a pound of gain is shown in the table first without considering the returns from the manure, and second where they are considered. It cost less to make a pound of gain with Groups I and VI, first when the manure was considered and second when not considered. Group I received corn meal, wheat meal and skim milk in the ratio of 1 pound of meal to 3 pounds of milk. Group VI received corn meal and skim milk. In no instance was the cost of a pound of gain excessive; and the higher cost with Groups VII and VIII, for example, where a part of the corn meal was replaced with wheat meal and soy bean meal, was due to the higher price of these food-stuffs, already referred to. These figures show that a pound of gain can be made at a moderate cost with hogs fed on grains when the market prices are really very high. It is also evident from the cost of a pound of gain with Group V that skim milk and other slops should be utilized as adjuncts in feeding hogs. The following table shows the gross and the net cost of a pound of increase in 1902 and 1903 and the average for the two years:

Group	1902		1903		Average	
	Gross cts.	Net cts.	Gross cts.	Net cts.	Gross cts.	Net cts.
I	4.1	3.2	4.6	3.3	4.4	3.3
II	4.8	3.6	5.3	3.7	5.1	3.7
III	5.1	3.7	5.1	3.5	5.1	3.6
IV	4.8	3.4	5.8	3.7	5.3	3.7
V	4.5	3.8	9.0	7.2	5.8	4.9
VI	4.4	3.3	4.7	3.3	4.6	3.3
VII	4.7	3.5	5.0	3.5	4.8	3.5
VIII	5.1	3.6	5.1	3.4	5.1	3.5

Table V shows the actual cost of the hogs when purchased, the cost of the food and the total cost, the amount sold for and the profit per group. In the statement the cost of caring for the animal is not taken into consid-

eration, nor are they credited with the value of the excrements. Were the labor charged to them and the value of the excrements added the profit would be considerably greater; and this would be the fairest way to estimate the profit, for the excrements simply mean an addition. The largest



Corn Meal and Skim Milk Corn Meal and Water

RELATIVE DEVELOPMENT OF LEAN AND FAT IN HOGS FED AS INDICATED

TABLE V—*Financial statement, 1902-1903*

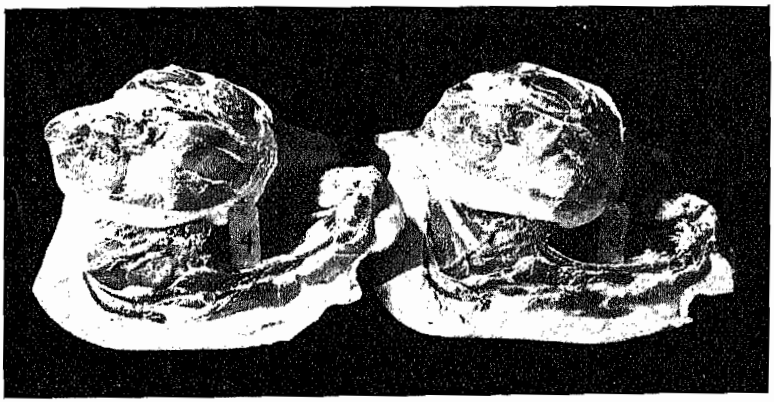
Group	Lot	Number in lot	Original cost	Cost		Amount sold for	Profit per group
				Food	Total		
I	1- 9	3-4	$15.83	$12.46	$28.29	$35.92	$7.63
II	2-10	3-4	16.46	14.35	30.81	36.08	5.27
III	3-11	3-4	16.15	15.67	31.82	37.44	5.62
IV	4-12	3-4	18.56	15.83	34.39	39.16	4.77
V	5-13	3-4	13.84	5.75	19.59	20.64	1.05
VI	6-14	3-4	13.92	12.95	26.87	31.83	4.96
VII	7-15	3-4	13.71	13.54	27.25	31.38	4.13
VIII	8-16	3-4	14.49	14.49	28.98	32.36	3.38

profit was made by Group I, $7.63, and the smallest by Group V, $1.05. A fair profit was made by all the other groups. A combination of corn meal, wheat meal and skim milk seemed to be more effective for the economical production of pork than corn meal and skim milk alone, the difference in profit between Groups I and VI being $2.67. The profit on Group I was almost twice as great as on Group VIII. The difference in profit between Groups VII and VIII is largely attributable to the high price of the soy beans. As the price of all food-stuffs is affected by the law of supply and demand a fair way to estimate the feeding value of soy beans and wheat meal, or any other adjunct for feeding to hogs, is not always by

market price, which is a varying factor, but rather by the actual gains made from the use of the food-stuffs.

The profit per head per group for 1902 and 1903 and the average for the two years are shown below, labor and manure being left out of consideration:

Group	Profit per head per group 1902	1903	Average
I	$1.41	$2.73	$2.18
II	.75	2.07	1.51
III	.56	2.39	1.61
IV	.81	1.77	1.36
V	.71	....	.30
VI	1.26	1.53	1.42
VII	.96	1.35	1.18
VIII	.59	1.25	.97



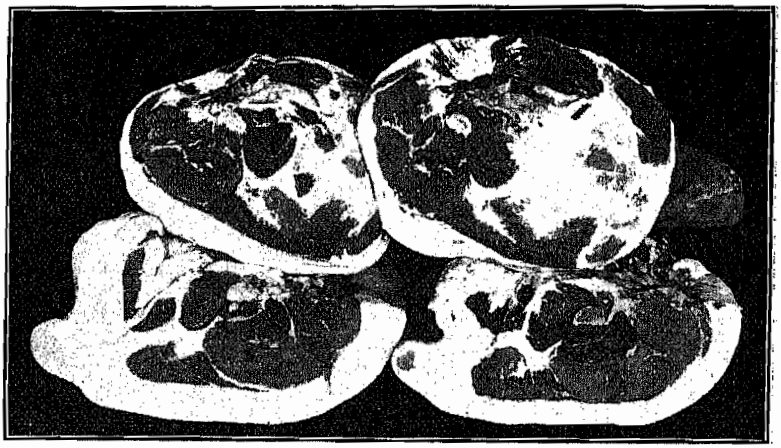
Corn Meal, Pea Vine Hay and Skim Milk — Corn Meal, Wheat Meal and Whey

RELATIVE DEVELOPMENT OF LEAN AND FAT IN HOGS FED AS INDICATED

The individual hogs fed in 1902 would have given at least as good profit as those fed in 1903, if not considerably better, provided all had been sold at the same price. Those in the experiment of 1902 were sold at $5.60, though the purchase price was 6 cents per pound. This was due to the fact that they happened to go on the market during an off season. One month earlier or later they would have sold for 6½ or 7 cents a pound. It is deemed fair that an explanation should be made. In 1903 the hogs were purchased for 6 cents a pound, the first four lots being sold for 6½ cents and the last four lots for 6 cents, and this explains in part the much larger profits on the first four groups than on the last four. The Knoxville packers want fat hogs, though these do not in their opinion make the finest quality of meat. They claim that fat hogs are more in demand and more profitable and hence they are willing to pay a little higher price for them. From their standpoint, as influenced by local conditions, they do not favor the feeding of a protein ration to hogs as was practiced when wheat meal or soy bean meal was substituted for a part

of the corn meal. It will be only a matter of time when present conditions will change, as our people are yearly becoming more discriminating about what they eat. As soon as they realize the choicer quality of meat produced by a better blending of the fat and lean there will be a greater demand for hogs fed as were Groups VII and VIII.

The profits from feeding hogs would be much larger on the average farm, where the products would not command as high prices as in the vicinity of a city; and hogs can undoubtedly be purchased more cheaply in the country. It should also be remembered that these hogs were purchased at top market prices from farmers who were quite as well able to feed them as the Station. It is also noteworthy that the hogs in 1902 were fed on 80-cent corn at a fair profit. What other evidence is needed to show the farmer the great mistake he makes in selling his hogs before finishing them? For if the Station can go out and buy the food-stuffs and the hogs at ruling market prices and feed them at a fair profit, it is certain that the farmer can do so at a good profit if he goes about it in a businesslike way.



RELATIVE DEVELOPMENT OF LEAN AND FAT IN HOGS IN GROUPS I-IV, FED ON CORN MEAL, WHEAT MEAL AND SKIM MILK

A record was not kept of the slaughter test of the first four groups in 1902, but otherwise Table VI is complete. The best slaughter tests were made by the hogs receiving corn meal, wheat meal and skim milk, there being little choice between the four groups; while those receiving corn meal and soy bean meal were somewhat lower. That these hogs were not so profitable as those of higher grade is shown by the fact that certain well-bred animals, reared and fed on the University farm, sold and slaughtered at the same time, dressed from 81 to 83 per cent, a difference of from 2 to 10 per cent in favor of the better-bred hogs. Of course the hogs dressing out the least per cent of good meat were in Group V, fed on corn meal and water. Mr. J. B. Madden, president of the East Tennessee Packing Co., made the following statement with regard to the slaughtered carcass:

"Lean meat predominated; the hams were especially well developed as to lean meat, as much so as is usually found in 250-pound corn-fed hogs. While this meat is of better quality, it is not quite so profitable for packing purposes owing to the demands of our local markets."

TABLE VI—*Slaughter test*

Lot	Number in lot	Weight at— farm	Weight at— yards	Loss—lbs.	Weight of carcass—lbs.	Per cent of meat	Intestinal fat
			1902				
1	3	.....	.....	.....	.....	.....	.....
2	3	.....	.....	.....	.....	.....	.....
3	3	.....	.....	.....	.....	.....	.....
4	3	.....	.....	.....	.....	.....	.....
5	3	.....	360	.....	276	76.6	8.0
6	3	.....	525	.....	404	76.9	8.5
7	3	.....	490	.....	384	78.4	9.0
8	3	.....	515	.....	390	75.7	8.0
			1903				
9	4	707	705	2	555	78.7	9.75
10	4	706	700	6	557	79.6	9.75
11	4	760	750	10	594	79.2	12.00
12	4	768	750	18	598	79.7	11.50
13	4	365	360	5	158	75.2	4.75
14	4	600	590	10	440	74.6	7.75
15	4	603	600	3	462	77.0	9.25
16	4	637	636	1	471	74.1	9.50

CONCLUSIONS

1 Where the ration fed was corn meal it took 4.6 pounds to make 1 pound of gain in 1901, 2.8 pounds in 1902 and 7.1 pounds in 1903, or an average of 4.1 pounds for the three years.

2 From the data presented under the table of rations used it would be an easy matter to estimate the amount of food required for hogs of varying weights. Hogs fed in the ratio of 1 pound of grain to 3, 6, 9 and 12 pounds of skim milk made the largest gains on from 9 to 12 pounds of skim milk. The consumption of skim milk reduced the consumption of concentrates considerably, though the cost of a pound of gain was lowest with a consumption of 1 pound of grain to 3 pounds of skim milk. This shows that animals will often consume larger quantities of food than they can digest and assimilate with the greatest economy.

3 The largest gain per head per day was made by Groups III and IV, 1.40 pound, followed closely by Groups I and VI, with a gain of 1.35 pound. The other groups all gained 1.30 pound with the exception of the lot fed corn meal and water. The largest gains were made by the groups receiving corn meal and wheat meal, mixed in the ratio of 2 to 1, with skim milk. The ratio of grain to skim milk was 1 to 9 with Group III and 1

to 12 with Group IV. This ratio made the best gain but was not the most economical.

4 It required 140 pounds of concentrates and 1640 pounds of skim milk to make 100 pounds of gain with Group IV, which received 1 pound of grain and 12 pounds of skim milk. As the ratio between the skim milk and grain decreased the consumption of concentrates increased.

5 Group I, which received 1 pound of grain to 3 pounds of skim milk, consumed 80 pounds more grain than Group IV and 990 pounds less of skim milk, which makes it evident that the ratio of grain to skim milk was too wide in the latter group.

6 The value of skim milk as an adjunct in hog feeding is shown by the fact that Group V consumed 4.1 pounds of corn meal for 1 pound of gain, whereas, Groups VI, VII and VIII consumed only 1.6 pound of concentrates with approximately 12 pounds of skim milk per pound of gain. In other words, 12 pounds of skim milk saved 2½ pounds of corn meal.

7 The experiment indicates that a bushel of corn produced 13.6 pounds of pork, which at 6 cents would give it a feeding value of 81 cents a bushel; at 5 cents, 68 cents a bushel; and at 7 cents, a feeding value of 95 cents. A farmer often sells his corn at 40 to 50 cents, when fat hogs would bring him 5 to 7 cents per pound, under the mistaken idea that he can not afford to feed it. Corn has been purchased at 80 cents a bushel and fed at a profit at the Station.

8 In the case of Group VI it was possible to secure 35 pounds of gain with a consumption of 416.5 pounds of skim milk. On the basis of the gain made from corn meal and water 416.5 pounds of skim milk made 21.4 pounds of gain when fed with corn meal. This would give it a feeding value of 31 cents when pork sells at 6 cents, of 26 cents when pork sells at 5 cents, and 36 cents when pork sells at 7 cents.

9 The manure from animals constitutes a part of the legitimate profits from any feeding experiment, as it takes the place of purchased commercial fertilizers, which are not so satisfactory. When 75 per cent of the fertilizer value of the food-stuffs consumed was credited to the animal, the average cost of a pound of gain for all groups was 3.7 cents; when no allowance was made for the manure, 5 cents. There is no reason why at least 75 per cent of the manurial constituents of the food-stuffs should not be returned to the soil under proper management, which according to these figures would reduce the cost of a pound of gain by 1.3 cent.

10 The highest gross cost of a pound of gain was with Group V, fed corn meal alone, 5.8 cents, or 1.4 cent more than Group I. The cost of a pound of gain was close in all instances and in no case was excessive.

11 The profit per group without considering the manurial value of the excrements was largest with Group I, $7.63; Groups II and III made a profit of $5.27 and $5.62, respectively; Groups VI and VII, $4.96 and $4.13; Group VIII, $3.38. The cost of soy beans in the case of the last group was probably responsible for the small profit shown, which indicates the importance of studying and utilizing those grains best adapted for the cheap production of pork. The price of food-stuffs has a marked influence on the profits from a feeding experiment.

12 These experiments clearly demonstrate the importance of skim milk as an adjunct food for hogs. The best ratio is one pound of grain to 3 to 8 pounds of skim milk.